Title: Floors, Tiles, and Patterns!

Brief Overview:

Students design improvements and make mathematical decisions for a layout of a Kindergarten room thanks to the generosity of a wealthy alumnus. This activity will utilize skills in geometry including: creating geometric patterns using polygons, finding area and perimeter, categorizing geometric shapes, and using deductive reasoning. Other math skills utilized are computation, problem solving, and data collection.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Estimation & Computation**
  Students will demonstrate their ability to apply estimation strategies in computation, with the use of technology, in measurement, and in problem solving. They will determine reasonableness of solutions.

- **Number Sense & Operations**
  Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and describe effects of operations on numbers.

- **Geometry & Spatial Sense**
  Students will demonstrate their ability to describe and apply geometric relationships using one, two, and three dimensional objects. They will demonstrate congruency, similarity, symmetry, and reflections and apply these concepts to the solution of geometric problems.

- **Measurement**
  Students will demonstrate and apply concepts of measurement using non-standard and standard units and metric and customary units. They will estimate and verify measurements. They will apply measurement to interdisciplinary and real-world problem solving situations.

- **Patterns & Relationships**
  Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.

Grade/Level:

Grades 4-6

Duration/Length:

4 class periods (45 minutes in duration each)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Geometric terms and concepts
- Creating an original pattern
- Computational skills

Objectives:

The students will:

- work cooperatively in groups.
- use manipulatives to solve problems.
- identify attributes of geometric shapes.
- find area and perimeter of a region.
- develop spatial sense.
- apply geometry in real life situations.
- solve problems using deductive reasoning.
- use language skills to communicate mathematics.
- share ideas with peers.

Materials/Resources/Printed Materials:

Provide each student in the class with:

- inch ruler
- calculator
- protractor
- lined paper
- inch grid paper
- red, blue, green, and brown markers

Development/Procedures/ Performance Assessment:

Task I and II:

- Teacher reads Performance Assessment prompt with the class.
- Teacher distributes lined paper (Resource Sheet #1).
- Students brainstorm ideas about geometric shapes in pairs for 10 minutes.
- Share results with the class.
- Review attributes of polygons with the class.
- Distribute Resource Sheet #2 (Kindergarten Floor Layout) rulers, and markers.

Task III and IV:

- Review area and perimeter (optional).
- Distribute student calculators.

Task V and VI:

- Read the prompt with the class.
- Distribute calculators.
- Review parts of the “Friendly Letter”.

Extension/Follow Up:

- Finding area and perimeter of other classrooms.
- Creating an original pattern using tessellations.
- Find actual cost of construction materials.
- Find symmetry and congruency in building layouts.

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FLOORS, TILES, AND PATTERNS!

Your principal received money from, Halbert Heinstein, a distinguished mathematician who was an alumnus of your school. His special request was to use the money for improving the Kindergarten rooms in your school and that the fifth graders should work on the project.

Task I

Activity A

Since Mr. Heinstein's favorite branch of math is Geometry, In your cooperative groups, brainstorm your prior knowledge on geometric shapes. List your ideas on the paper provided. You have five minutes to complete this activity.

Activity B

Share your results with the class.

Task II

Activity A

Design a Floor Space Using Regular Polygons

Your first mission is to create a new floor for the Kindergarten classes.
Choose at least two shapes of the four given to create a pattern for the floor.
Use the grid to design and color your floor model.

Activity B

Now you have finished your floor design. Explain the pattern that you used.

_____

_____

_____

_____

Task III

Activity A

Finding Area

Find the area of your floor model using your ruler and your scale.

The area is _____

Explain how you determined your answer.

_____

_____

_____

_____

Activity B

Finding Perimeter

You are considering adding a border to your floor model. Measure the perimeter of your floor model using your ruler

The perimeter is _____

Write the number sentence showing how you came up with your answer.

_____

Task IV

Activity A

Tallying and Calculating Tile Cost

Use the chart below to tally the tiles you used in your floor model. You may use a calculator.

Tally and Cost Chart

Shape	# of Tiles I used	Cost per Tile	Cost of Tiles I used
Triangle		$4.99	
Rhombus		$19.99	
Rectangle		$15.99	
Square		$7.99	
		GRAND TOTAL for each Kindergarten room	

Activity B

You are over budget! Look at the chart you just finished, how could you change the GRAND TOTAL to save money? Explain the changes you made to decrease the cost of your floor.

_____

_____

_____

_____

Task V

Activity A

Congratulations, you have surplus money to purchase furniture. The Kindergarten teachers suggestedbuying computer tables.They have three specific requirements for you to consider.Here is the note they wrote to you:

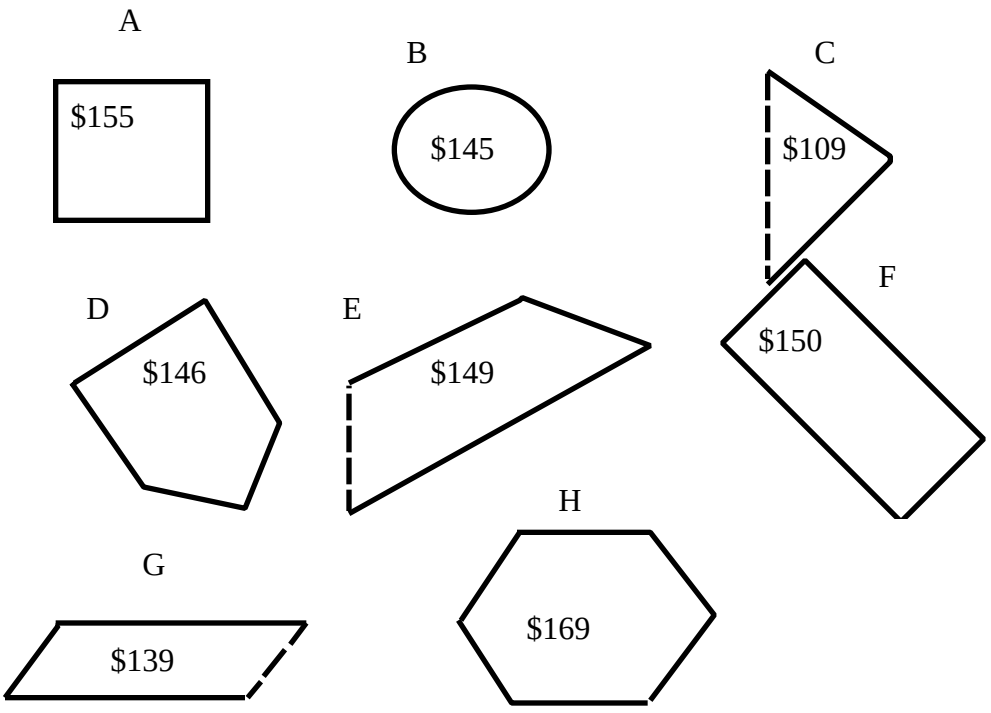
Dear Fifth Grade Students,we are so pleased to know that that you have finished our floor models. They look great! The principal told us we have leftover money to buy some furniture. From the POLYGON Furniture Catalog please select the ones that meet these three needs. We decided that we need furniture that:

1) costs less than $150
2) has a right angle to fit in a corner
3) has at least one opposite sides are parallel

Examine the catalog of table shapes below. Draw an "X" mark on the shapes that don't fit the teacher's requirements.

POLYGON FURNITURE

Tables, Tables, Tables, Galore! p.97



Activity B

Which figure did you choose? _____

Explain why you chose this computer table.

_____

_____

_____

_____

Task VI

Halbert Heinstein Letter

Write a letter to Mr. Heinstein thanking him for his donation. Be sure to include information about expenditures the fifth grade made for the Kindergarten. Write your letter below.

AREA AND PERIMETER ANSWER KEY

Task III

Activity A

Finding Area

Find the area of your floor model using your ruler and your scale.

The area is 34 SQUARE FEET

Explain how you determined your answer.

I MEASURED EACH BOX AND FOUND IT MEASURED ONE INCH, THEN I COUNTED THE BOXES.
or
I SPLIT THE FLOOR MODEL INTO TWO REGULAR SHAPES, MEASURED THE LENGTH AND WIDTH, MULTIPLIED THEM TOGETHER, THEN ADDED UP BOTH AREAS TO GET THE TOTAL AREA.

Activity B

Finding Perimeter

You are considering adding a border to your floor model. Measure the perimeter of your floor model and your ruler

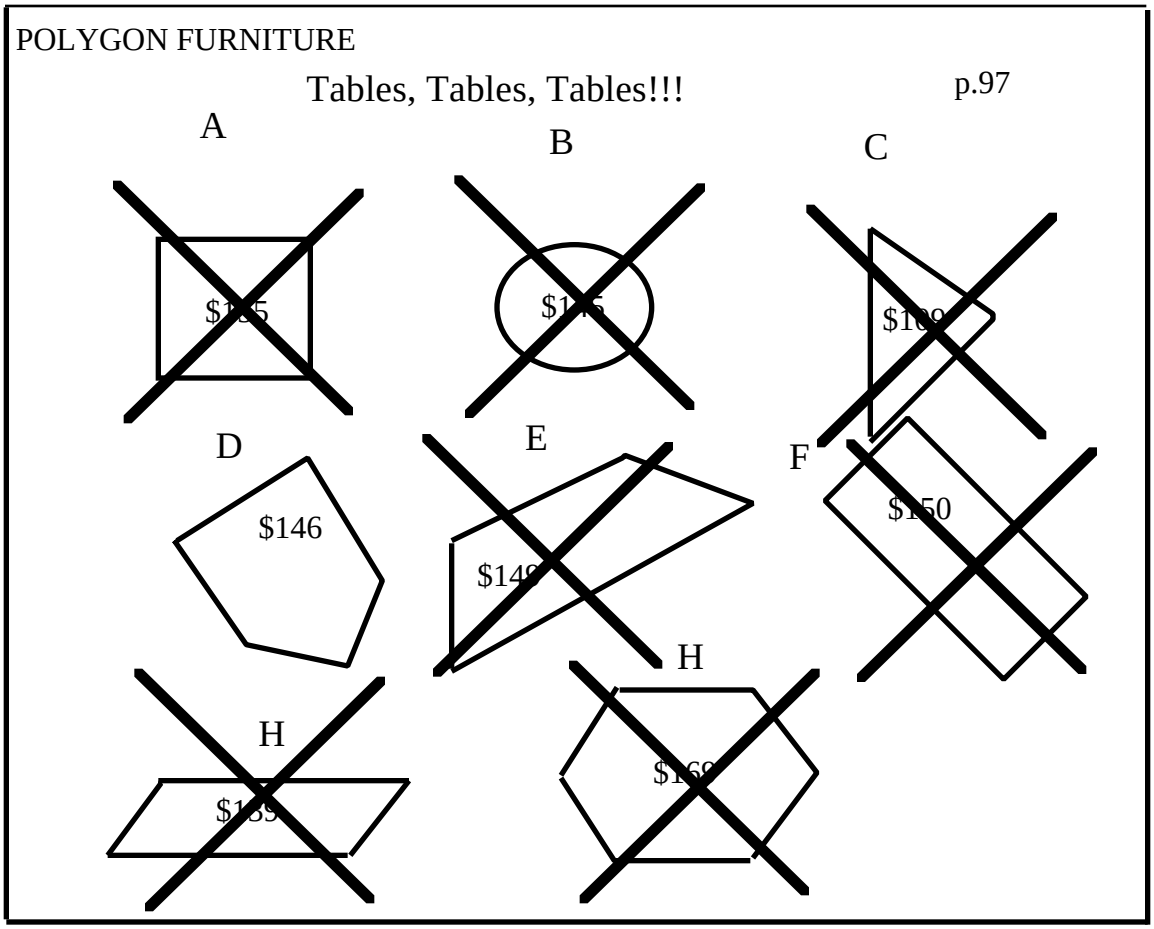
The perimeter is 24 FEET

Write the number sentence showing how you came up with your answer.

6+ 4+ 1+ 2+ 5+ 6 = 24 FEET

ANSWER KEY

Examine the catalog of table shapes below. Draw an "X" mark on the shapes that don't fit the teacher's requirements.



Activity 5B

Which figure did you choose? D

Figure A costs too much.
Figure B has no right angles or parallel lines.
Figure C costs too much and has no parallel lines.
Figure E has no right angles.
Figure F costs too much.
Figure G has no right angles.
Figure H has no right angles.

SCORING TOOLS FOR FLOORS, TILES, AND PATTERNS

Task I

Activities A and B

Student's Brainstorming Activity- None

Task II

Activity A

2 points -Student used 2 or more shapes given and made a color pattern.

1 point -Student used only one shape given and made a color pattern
-Student used two or more shapes and did not make a pattern.

0 point- Student did not use shapes given or create a pattern.

Activity B

1 point -Student made a pattern: repeating and/or arithmetic pattern.

0 point -Student did not have a reasonable explanation for the pattern.

Task III

Activity A

2 points -Student gave correct number and appropriate unit of measurement and a reasonable explanation given for calculating area.

1point -Student gave correct area and an unreasonable explanation.
-Student gave incorrect area and an reasonable explanation.

0 point -Student gave incorrect area and gave no explanation.

Activity B

2 points - Student gave correct perimeter and appropriate unit of measurement and correct number sentence.

1 point - Student gave correct perimeter and incorrect unit of measurement.
- Student gave correct perimeter and incorrect number sentence.
- Student gave incorrect perimeter and correct number sentence.

0 points - Student gave incorrect perimeter and incorrect number sentence.

Task IV

Activity A

4 points - Student filled in all boxes and GRAND TOTAL correctly.

3 points - Student filled in all 6- 8 boxes correctly.

2 points - Student filled in 3-5 boxes correctly.

1 point - Student filled in all boxes with incorrect answers.

0 point - Student gave no response.

Activity B

1 point - Student made reasonable changes to lower GRAND TOTAL.

0 point - Student's change did not show a decrease.

Task V

Activity A

3 points - Student marked all shapes correctly.

2 point - Student marked at least 5 shapes correctly.

1 point - Student marked less than 5 shapes correctly.

0 point - Student marked all shapes incorrectly.

Activity B

2 points - Students gave correct shape and gave all three teacher's requirements.

1 point - Student gave correct shape and no explanation.
- Student gave incorrect shape and an explanation given for the choice.

0 point - Student gave incorrect shape and no explanation.

Task VI

4 points - 1) Student used correct letter format including the five parts of a Friendly - Thank You Letter.

2) Student used information on the cost of tiles and furniture.

3) Student addressed proper audience.

4) Student consistently used correct grammar, spelling, and punctuation.

3 points - Student used information on the cost of tiles and furniture and is missing one of the categories above.

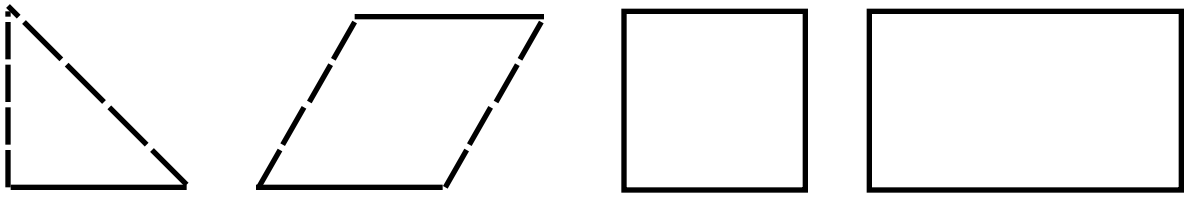
2 points - Student used information on the cost of tiles and furniture and is missing two of the categories above.

1 point - Student missed two of the categories above.

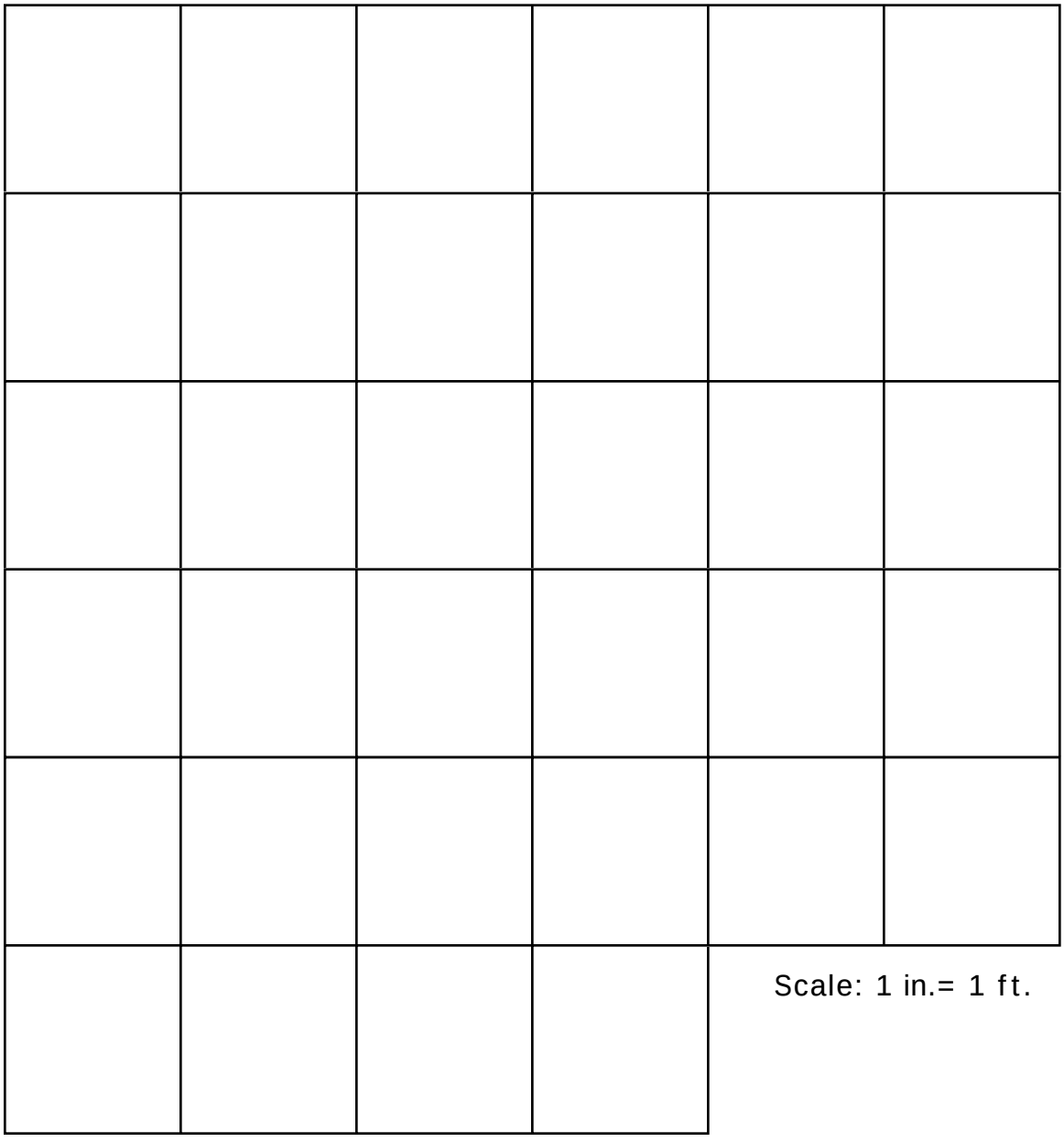
0 point - Student missed all four categories.

Name:_____ Resource Sheet #1

Directions: Create and color a design using at least two of these shapes:



Kindergarten Floor Layout



Scale: 1 in.= 1 ft.